

CLAIMS

1. A pneumatic endstop surface effect damper, said pneumatic endstop surface effect damper comprised of an air piston housing with an air piston inner housing wall

5 defining an air piston inner chamber, an air piston movable in an up stroke first direction and an opposite down stroke second direction inside said air piston housing and along said air piston inner housing wall, said air piston dividing said air piston inner chamber into a first upper variable volume chamber and a second lower variable volume chamber, said air piston including a lubricated viscous elastomer surface effect damper which engages said inner wall and provides a surface effect damping of the piston moving along said inner wall, said air piston including a movable valve system actuated by a change in the stroke direction of said air piston wherein said movable valve system releases an air pressure from said upper variable volume chamber when said piston changes from said up stroke first direction to said opposite 10 down stroke direction and releases an air pressure from said lower variable volume chamber when said piston changes from said down stroke direction to said up stroke direction.

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2. A damper as claimed in claim 1, said air piston including an accumulator chamber

20 wherein said movable valve system provides for an air flow from said upper variable volume chamber into said accumulator chamber when said air piston moves in said up stroke first direction, and said movable valve system provides for an air flow from said lower variable volume chamber into said accumulator chamber when said air piston moves in said opposite down stroke direction.

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3. A damper as claimed in claim 1, wherein said lubricated viscous elastomer surface effect damper is comprised of a self-lubricating elastomeric material.

30 4. A damper as claimed in claim 1, wherein said lubricated viscous elastomer surface effect damper is comprised of a greased elastomeric surface.

5. A damper as claimed in claim 1, wherein said movable valve system is comprised of a rolling ball valve.

6. A damper as claimed in claim 1, wherein said movable valve system is comprised
5 of a slide valve.

7. A damper as claimed in claim 1, wherein said movable valve system is comprised of an elastomeric mover.

10 8. A damper as claimed in claim 7, wherein said lubricated viscous elastomer surface effect damper comprises said movable valve system elastomeric mover.

9. A damper as claimed in claim 7, wherein said movable valve system elastomeric mover is separate from said lubricated viscous elastomer surface effect damper .

15 10. A damper as claimed in claim 1, said air piston housing including an air intake check valve for providing an inflow of atmospheric air into said air piston inner chamber .

20 11. A damper as claimed in claim 1, said air piston having an air piston engagement area with said inner wall and said elastomer surface effect damper having a surface effect engagement area with said inner wall with said surface effect engagement area at least fifty percent of said air piston engagement area.

25 12. A pneumatic endstop surface effect damper, said pneumatic endstop surface effect damper comprised of a piston housing with an inner housing wall defining an inner chamber, a pneumatic piston movable in a first direction stroke and an opposite second direction stroke inside said piston housing and along said inner housing wall, said piston dividing said piston housing inner chamber into a first variable volume
30 chamber and a second variable volume chamber, said piston including an elastomer surface effect damper which engages said inner wall and provides a surface effect

damping of the piston moving along said inner wall, said piston including a valve system actuated by a change in the stroke direction of said piston wherein said valve system releases a pneumatic pressure from said first variable volume chamber when said piston changes from said first direction stroke to said opposite second direction stroke and releases a pneumatic pressure from said second variable volume chamber when said piston changes from said second direction stroke to said first direction stroke.

5 13. A damper as claimed in claim 12, said piston including a constant volume
10 10 accumulator chamber wherein said valve system provides for a pneumatic flow from
 said first variable volume chamber into said accumulator chamber when said piston
 moves in said first direction, and said movable valve system provides for a pneumatic
 flow from said second variable volume chamber into said accumulator chamber when
 said piston moves in said opposite second direction.

15 14. A damper as claimed in claim 12, wherein said elastomer surface effect damper is
 comprised of a lubricated elastomeric material.

20 15. A damper as claimed in claim 12, wherein said valve system is comprised of a
 rolling ball valve.

16. A damper as claimed in claim 12, wherein said valve system is comprised of a
slide valve.

25 17. A damper as claimed in claim 12, wherein said valve system is comprised of an
 elastomeric mover.

18. A damper as claimed in claim 17, wherein said elastomer surface effect damper
comprises said valve system elastomeric mover.

19. A damper as claimed in claim 12 , said piston having a piston engagement area with said inner wall and said elastomer surface effect damper having a surface effect engagement area with said inner wall with said surface effect engagement area at least fifty percent of said piston engagement area.

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20. A pneumatic endstop surface effect damper, said pneumatic endstop surface effect damper comprised of a piston housing with an inner housing wall defining an inner chamber, a pneumatic piston movable in a first direction stroke and an opposite second direction stroke inside said piston housing and along said inner housing wall, 10 said piston dividing said piston housing inner chamber into a first variable volume chamber and a second variable volume chamber, said piston including an elastomer surface effect damper which engages said inner wall and provides a surface effect damping of the piston moving along said inner wall, said piston including a constant volume accumulator chamber and a movable valve system actuated by a change in the 15 stroke direction of said piston wherein said movable valve system provides for a pneumatic flow from said first variable volume chamber into said accumulator chamber when said piston moves in said first direction and releases a pneumatic pressure from said first variable volume chamber when said piston changes from said first direction stroke to said opposite second direction stroke, and provides for a 20 pneumatic flow from said second variable volume chamber into said accumulator chamber when said piston moves in said second direction and releases a pneumatic pressure from said second variable volume chamber when said piston changes from said second direction stroke to said first direction stroke.

25 21. A damper as claimed in claim 20, wherein said elastomer surface effect damper is comprised of a lubricated elastomeric material.

22. A damper as claimed in claim 20, wherein said valve system is comprised of a rolling ball valve.

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23. A damper as claimed in claim 20, wherein said valve system is comprised of a slide valve.

24. A damper as claimed in claim 23, wherein said valve system is comprised of an
5 elastomeric mover.

25. A damper as claimed in claim 24, wherein said elastomer surface effect damper comprises said valve system elastomeric mover.

10 26. A pneumatic endstop surface effect damper, said pneumatic endstop surface effect damper comprised of a piston housing with an inner housing wall defining an inner chamber, a rigid pneumatic piston movable in a first direction stroke and an opposite second direction stroke inside said piston housing and along said inner housing wall, said piston dividing said piston housing inner chamber into a first variable volume chamber and a second variable volume chamber, said piston including a movable valve system actuated by a change in the stroke direction of said piston wherein said movable valve system releases a pneumatic pressure from said first variable volume chamber when said piston changes from said first direction stroke to said opposite second direction stroke and releases a pneumatic pressure from said second variable 15 volume chamber when said piston changes from said second direction stroke to said first direction stroke, said damper including a surface effect damper elastomeric member between said piston housing and said pneumatic piston which inhibits movement of said piston along said wall with a surface effect damping of the piston motion along said wall.

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25 27. A damper as claimed in claim 26, said rigid piston including a constant volume accumulator chamber wherein said movable valve system provides for a pneumatic flow from said first variable volume chamber into said accumulator chamber when said piston moves in said first direction, and said movable valve system provides for a 30 pneumatic flow from said second variable volume chamber into said accumulator chamber when said piston moves in said opposite second direction.

28. A method of making a pneumatic endstop surface effect damper, said method comprising: providing a piston housing with an inner housing wall defining an inner chamber, providing a rigid pneumatic piston for dividing said piston housing inner chamber into a first variable volume chamber and a second variable volume chamber, providing a pneumatic piston valve system for controlling the pneumatic flow of a gas through said pneumatic piston, providing a surface effect damper elastomeric member for damping a relative motion between said piston housing and said rigid pneumatic piston,

5 10 assembling said rigid pneumatic piston, said pneumatic piston valve system, and said surface effect damper elastomeric member into said piston housing inner chamber wherein said rigid pneumatic piston is movable in a first direction stroke and an opposite second direction stroke inside said piston housing and along said inner housing wall, said piston dividing said piston housing inner chamber into a first variable volume chamber and a second variable volume chamber with said pneumatic piston valve system actuated by a change in the stroke direction of said piston wherein said valve system releases a pneumatic pressure from said first variable volume chamber when said piston changes from said first direction stroke to said opposite second direction stroke and releases a pneumatic pressure from said second variable

15 20 volume chamber when said piston changes from said second direction stroke to said first direction stroke, and with said surface effect damper elastomeric member positioned between said housing and said pneumatic piston to inhibit movement of said piston along said housing wall with a surface effect damping force.